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Survey on Various Intelligent Traffic Management Schemes for Emergency Vehicle

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Abstract— Traffic congestion on city road networks is one of the main issues to be addressed by today's traffic management schemes. Traffic congestion on city roads many times leads to delay in emergency services (i.e. Ambulance, Firefighter, Police, etc.). A survey on various traffic management schemes specifically designed to help emergency vehicle has been presented in this paper. Traffic management schemes used currently and their limitations have been discussed. Researchers have used several techniques such as Embedded Systems, Wireless Sensors Network, Intelligent Ambulance and Image Processing for traffic management. These techniques have been discussed thoroughly and comparative analysis has been made.

Keywords- *Intelligent Traffic management, Emergency Vehicle, Ambulance, Image Processing, Audio detection, Wireless Technologies*

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I. INTRODUCTION

We are known to the fact that, number of vehicles is increasing exponentially, but infrastructure for transportation we have, is not sufficient to satisfy their needs. Due to this, valuable time of public is being lost every day. This also leads to huge economic problems.

Main problem occurs when this traffic congestion costs life of someone. It should not be surprising that traffic congestion affects almost all emergency vehicles, which can be too much hazardous to affected people. There isn't any quick solution for this. Government can't continue making roads everywhere. There should be a technical solution to get away with this. There should be a solution by which these emergency vehicles can get their way in midst of traffic and traffic signals.

This paper provides a survey of different techniques that has been implemented in one or another part of the world. Instead of mixing of all these methodologies at once, these have been divided according to techniques used. In this paper, current schemes used for traffic management has been discussed thoroughly wiz. Simple Traffic Management Systems, Intelligent Traffic Management System based on Image Processing, Intelligent Traffic Management System using Wireless Technologies, and Intelligent Traffic Management System using Wireless Technologies.

Literature survey has been done according to techniques researchers have used. The techniques described in this paper are Embedded System, Wireless Sensor Networks, Active RFID and GSM Technology, Intelligent Ambulance and Image Processing. Not only description, but comparative analysis has been done in this paper.

II. CURRENT TRAFFIC MANAGEMENT SCHEMES

In real world there are many traffic management schemes established already. These schemes are described below:

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A. *Simple Traffic Management Scheme*

This is the simplest form of traffic management, which includes human in the system. In this scheme, a traffic officer is placed on each and every cross-section of roads; the traffic police controls flow of traffic. As shown in fig. 1, a police officer stands in middle of road and monitors flow of traffic. In time of congestion she/he gives signals to the vehicle driver whether to drive or stop. She/he is also able to recognize emergency case, so she/he can choose which lane needs more priority than other. This scheme is most efficient than any other technique. But as it includes human as a part of system this scheme is inadequate. Efficiency of system depends on experience and capability of the person.
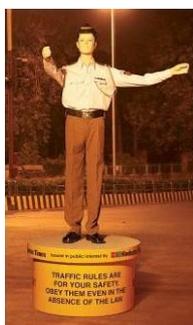

Figure 1: Traffic Police at Road Crossing

B. *Automatic Traffic Management Scheme*

Figure 2: A Sample Traffic Signal

In order to remove most weak link (i.e. human) in above system, an automatic traffic management scheme is suggested. This system includes simple three color traffic signal, which we see every day. Generally for each lane 120 seconds of green light is on. Before green light, yellow light flashes for 20 second, signifying to start your vehicle and be ready to go. For all the time red light is on, ordering each vehicle to stop. This system cannot identify emergency vehicle, it treats normal car and ambulance same way. So there are chances of delay

in emergency services. Drivers disobeying signal rules are also headache, sometimes they causes serious accidents.

C. *Intelligent Traffic Management Scheme based on Image Processing*

This scheme includes cameras, which are meant to measure length of traffic in the system. Cameras are mounted on a high pole so they can cover long distance. Video footage covered by camera is analyzed by a computer chip in order to detect object (i.e. car, truck, etc.) on road. Different object detection techniques are being used now days. Cameras are also useful in detection of violation of traffic laws.

D. *Intelligent Traffic Management Scheme using Wireless Technologies*

In this scheme, emergency vehicle and traffic signal are equipped with wireless antennas and receiver. As emergency vehicle come near to an inter-section, it broadcast a signal, to notify traffic signal its presence. As soon as traffic signal receive signal from emergency vehicle it gives green light to that particular lane, in which emergency vehicle is coming.

III.   LITERATURE SURVEY

In this section, various solutions to the traffic congestion problems suggested in the literature are presented:

A. *Embedded System*

Intelligent Traffic Signal Control System by Dinesh Rotake & Prof. Swapnili Karmore[1] (2012). Here system uses IR sensors, AVR-32 microcontroller with programmable flash memory and built in 8-channels ADC. IR (i.e. Infrared) sensor is programmed to detect emergency vehicle and microcontroller is designed in such a way to give red signal to all other lane but one with emergency vehicle. Limitations: Here IR sensors are used, due to various climate conditions present in India, IR sensors may need to keep in safe place or a strong

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box. Price factor of implementation of this system is high. So it is not advisable to implement this system.

B. *Wireless Sensor Networks*

Priority Based Traffic Lights Controller Using Wireless Sensor Networks by Shruthi K R and Vinodha K[2] (2012). Wireless Sensor Network is being used as communication infrastructure in the proposed traffic light controller. System uses fuzzy logic to define direction of emergency vehicle. Central monitoring system collects all information and gives appropriate response. Limitations: Communication in Wireless Sensor Network is still a research field. Data exchange in between Sensor is not reliable. And as specified before Sensors need to become robust in order to survive in Indian weather.

C. *Active RFID and GSM Technology*

Road Traffic Congestion Monitoring and Measurement using Active RFID and GSM Technology by Koushik Mandal, Arindam Sen, Abhijnan Chakraborty and Siuli Roy[3] (2011). System includes Active RFID tag, Wireless Router, Wireless Coordinator, GSM modems, and Monitoring Station software. Wireless devices collects data from Active RFID tags, these devices are mounted at roadside. Monitoring station collects all data through GSM, and reply to corresponding traffic signal. Limitations: Involvement of various communication devices makes implementation costly. Wireless communications have their own drawbacks. A Monitoring Station needs to be setup.

D. *Intelligent Ambulance*

Design of Intelligent Ambulance and Traffic Control by Sarika B. Kale, and Gajanan P. Dhok[4] (2013). Ambulance will consist of Heart Beat and Temperature sensor. When key is pressed, heart beats and temp values will be sent to pre-defined mobile phone (Hospital) using GSM. On signal there will be two RFID readers which will detect traffic density on two roads. When ambulance is detected on any road signal for that side will be green. Limitations: All ambulances must equip with special instruments other than medical. Some other integration also needs

to implement this system. RFID tags are not reliable because they fail in short period of time.

E. *Image Processing*

Image Processing Based Intelligent Traffic Controller by Vikramaditya Dangi, Amol Parab, Kshitij Pawar and S.S Rathod[5] (2012). A camera is fixed on polls or other tall structures to overlook the traffic scene. Images extracted from the video are then analysed to detect and count vehicles. Then depending on the signal cycle, time is allotted to each lane. The system also takes into account the emergency vehicles at the intersection. If such a vehicle is detected, the lane is given priority over the others Limitations: Camera used, have to be robust. When ambulances arrive from more than one lane system fails, it gives green light to all lanes.

IV. CONCLUSION

After surveying various traffic management schemes, we can conclude that traffic management using Image Processing is suitable for implementation. Though there are some drawbacks which can be overcome by adding some features from other technologies. Whereas other techniques are costly and not suitable in Indian conditions, so there is lot of research going in use of Image Processing for traffic management. One can use Audio processing technique in order to decide whether ambulance is in emergency or not.

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